

REMARKS

Claims 1-7 were pending in the present application. Claims 1-7 have been canceled and new claims 8-19 are added herein. Thus claims 8-19 are now pending. The applicants respectfully request reconsideration and allowance of the present application in view of the above amendments and the following remarks.

The applicants note with appreciation the acknowledgement of the claim for priority under section 119 and the notice that all certified copies of the priority documents have been received.

The applicants acknowledge and appreciate receiving a copy of the form PTO-1449 submitted with the Information Disclosure Statement filed on 12/4/2003 on which the Examiner has initialed all listed items.

Claims 1-7 are rejected under the judicially created doctrine of obviousness type double patenting. Claims 1-7 are canceled herein rendering the rejection moot.

Claims 1-7 stand rejected under 35 USC §102(b) as being allegedly anticipated by Kenny, U.S. Patent No. 4,785,337. Claims 1-7 have been canceled herein rendering the rejection moot.

New claims 8 – 19 have been added herein and include some of the features of canceled claims 1-7 and therefore will be discussed herein below with regard to Kenny. Favorable consideration is respectfully requested.

Independent claims 8 and 17 recite the novel embodiment of a vertical trench type semiconductor device having a gate electrode of a polycrystalline silicon which is doped with boron, the gate electrode filling the trench with the gate insulation film interposed.

Kenny describes a DRAM having a trench capacitor construction. While Kenny, at best, describes that a lateral P-channel MOSFET has a gate electrode 34, drain 38 and a source 36,

Kenny fails to disclose or suggest a dopant in the gate electrode 34. Kenny further fails to disclose or suggest a vertical MOS device including a channel arranged in a longitudinal direction associated with a trench sidewall such as the trench structure recited in independent claims 8 and 17.

The Examiner has asserted that Kenny discloses a P-channel MOSFET comprising boron diffusion suppressing film. Applicants respectfully disagree. Kenny describes, on col. 10, lines 61 – 62, that the gate insulation layer 34A is merely a SiO₂ layer formed by thermal oxidation. Kenny fails to disclose the problem of threshold voltage fluctuation or gate withstand voltage deterioration when boron diffuses into the gate insulation film. The noted problem is addressed in the present invention.

Kenny describes that an ONO structure 26 is arranged between the boron doped polysilicon 22 and the trench sidewall in the trench capacitor portion. However, the ONO structure 26 does not relate to the gate withstand voltage deterioration and threshold fluctuation. Therefore, Applicants do not believe that Kenny is capable of teaching the improved effects of the present invention such as reducing threshold voltage fluctuation and improving the gate withstand voltage. Accordingly new claims 8 and 17 are distinguishable over Kenny in the above regard.

New claims 10 and 17 recite the novel embodiment in which the ONO nitride film is more than 10 nm so that it can protect against boron diffusion. The film described in Kenny is only 4 – 7 nm, so it cannot achieve the boron diffusion protection discussed above. Therefore, claims 10 and 17 are distinguishable over Kenny in this regard.

New claims 11 and 18 recite the novel embodiment in which the sidewall, specifically, the channel side oxidation film BOX thickness is about 100 nm and the required withstand

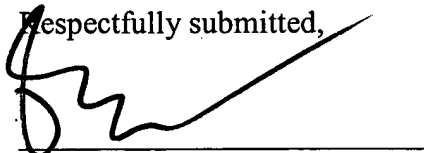
voltage of the ONO film as the gate insulation layer can be achieved by the oxidation film BOX itself. The thickness of the oxidation film described in Kenny is only 2 – 4 nm, which is not sufficient for expecting to be able to achieve the required withstand voltage. Therefore, claims 11 and 18 are distinguishable over Kenny.

New claims 14 – 19 recite the novel embodiment in which the ONO film is formed on the sidewall portion locally. The oxide film thicker than the ONO covers the corner portion of the trench or the entrance portion of the trench. In Kenney, the entire surface of the trenchwall is described as having ONO 26 affixed thereto. Moreover, there is no thick oxidation film arranged on the base portion or the entrance portion. Accordingly, Kenny cannot achieve the effect of the present invention in which voltage withstand deterioration caused by electric field concentration in the corner portion is prevented. Claims 14-19 are thus distinguishable over Kenny.

In view of the foregoing, the applicants respectfully submit that the present application is in condition for allowance. A timely notice to that effect is respectfully requested. If questions relating to patentability remain, the examiner is invited to contact the undersigned by telephone.

Please charge any unforeseen fees that may be due to Deposit Account No. 50-1147.

Respectfully submitted,



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